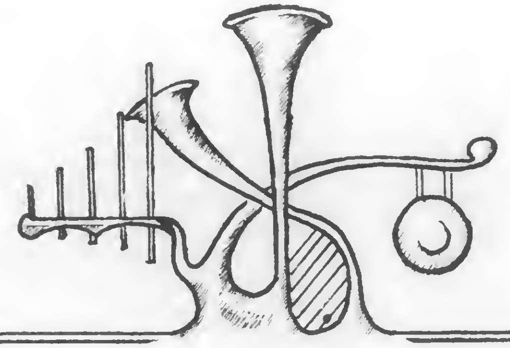
Volume I #2 August, 1985

EXPERIMENTAL MUSICAL INSTRUMENTS



NEWSLETTER FOR DESIGN, CONSTRUCTION AND ENJOYMENT OF NEW SOUND SOURCES

SHARON ROWELL'S CLAY OCARINAS

Sharon Rowell is one of a handful of craftspeople currently doing creative work with vessel flutes. Rowell makes fipple flutes of clay with one, three, and sometimes four separate chambers, capable of as many simultaneous voices. (Fipple flutes are those which sound by means of a fipple, or recorder-style mouthpiece.) The wonderful simplicity of ocarina fingering makes it possible to obtain a range of an octave or more from each of two chambers, each separately controlled by the fingers of one hand. The additional chamber or chambers serve as a drone, or can at the player's discretion remain mute. With some of Rowell's designs the drones produce a limited scale, by means of some unorthodox fingering techniques.

Vessel flutes are flutes in which the vibrating air is contained in an enclosed chamber rather than an open-ended tube. It is characteristic of the acoustics of vessel flutes that while the volume of the chamber is an essential factor, the maker has great freedom regarding the shape. Rowell works primarily with globular shapes, giving her many-chambered instruments the look of a cluster of hanging fruit. The bigger ones are five or six inches in diameter; the smallest perhaps half that. The shape helps create a rich, round, hooty sound, full in the fundamental with minimal overtone content.

It is tempting to glorify the triple ocarinas for their ability to produce contrapuntal music. But the richest aspect of their personality appears when one plays the two melody chambers in unison. The sound then takes on a deep, warm quality that seems to come from nowhere and everywhere. Unison playing also brings out a private and personal quality in the instruments: Rowell says, "...I'm sort of a hermit, and I think of these instruments as solo instruments to be used chiefly for private meditation and relaxation. Their most exquisite beauty is heard chiefly by the player himself. For his ears are closest, and therefore his ears pick up the most of the stereophonic quality that two chambers, played together in unison, provide. In this sense they are sort of 'unreal' or 'imaginary', in that their beauty is absolutely astonishing to the player, whereas the onlooker (onlistener?), although enjoying the sounds very much also, is hearing something quite different."

continued on page 8

IN THIS ISSUE

LETTERS

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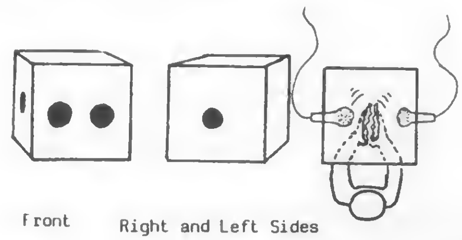
I was very happy to discover your publication on the desk of a neighbor and have found great inspiration in your first issue.

I am a composer and performer of new music working in the popular entertainment field. My goals are to deepen and broaden the popular music idiom (as opposed to popularizing and humanizing the concert "New Music" idiom) by combining new instrument construction and innovative vocal techniques with the back-beat and harmonic "groove" of today's pop music. Our group is called DEGA-RAY and we are having a terribly hard time breaking into the popular music scene.

However, I would like to share a technique of sound production and its accompanying theory with your readers in hopes of finding like minds in the field of Micro-Acoustics.

It all started when I wanted to bring a low volume sound effect on stage. In that the stage was a high volume environment complete with drums, electric bass, electric guitar and amplified vocals, I had to find a way to isolate the performer of, say, ripping paper for fear of microphone feedback. The input volume of the microphone in order to amplify ripping paper had to be higher than the stage could handle. The answer came in the form of the "Micro-Sensitive Sound Chamber": a box, padded thoroughly on the inside, with a hole on the right and left sides large enough to insert microphones, and two holes facing me, large enough to put my hands, forearms and the object-to-make-sound within. The rest of the box is closed (see picture).



Front   Right and Left Sides

Top View in Performance

The results were quite satisfactory for my live melding of electric rock music and acoustic sound effects.

Now, to carry the concept a step further: Is there a world of acoustic phenomena behind our range of hearing, such as the microscope reveals the visual world "within"? Could a Micro-Sensitive Sound Chamber be built in such a sound-sterile environs as to be able to detect and amplify sounds we have never heard: the breathing of a flea, the heart beat of a fly, the growth of a seedling? And what might be the nature of these sounds, their timbres, tones and blends? Perhaps our scope of hearing is limited to this dimension in the same way as our concept of the Earth before the telescope.

In any case, I would appreciate any feedback from readers with similar thoughts. In the meantime I'll be ripping paper along with the drums and bass in an even 4/4 funk beat.

Sincerely,

Dagen Julty
Music Studio "A"
1350 Florida
San Francisco, CA 94110

From the editor: Leif Brush, interviewed in the current issue of **Musicworks** (see page 16 of this issue), has made some very interesting excursions into the world of microsonics. Some of his explorations have focused on sounds very much akin to that of the seedling growing. The same issue of **Musicworks** has an interview with the people from the Logos Foundation in Belgium who also do some work with microsonics, sometimes without the aid of electronics. Prent Rodgers, currently living in San Jose, and Tom Nunn in San Francisco both have built devices that make little sounds bigger by affixing small sound-making objects to soundboards with contact mikes attached. Tom has written an article on one of these instruments which will be appearing in one of the coming issues of **Experimental Musical Instruments**.

The world of microsonics is, as Dagan Julty suggests, a world full of potential for sound art, still very little explored. **Experimental Musical Instruments**, along with Dagan, is interested in hearing from people active in this field.

EXPERIMENTAL MUSICAL INSTRUMENTS
Newsletter for Design, Construction and Enjoyment of New Sound Sources

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Your newsletter looks exciting and I am looking forward to reading future copies and contributing if and when whatever I've got going fits your needs.

One weakness that drives me crazy -- illustrations that leave out critical information. See page 4 [vol. 1 #1, in the article about Robert Rutman's Steel Cello] -- What happens at the point above the "turnbuckle for adjusting string tension" where the string passes through/ties off and the new string begins?

Thanks for letting me know and subscribe.

Tom Walther
Oakland, CA

From the editor: Rutman attaches both the sounding string and the turnbuckle on the tension-adjusting wire to a single eye bolt which passes through a hole drilled in the resonator sheet, as shown at right.

****

What a treat to find someone producing a newsletter on this subject, and so close too!

I have been designing my "dream marimba" for nearly twenty years, and have begun to put the whole thing into book form. In the process I've met a great number of talented and fascinating people, and many of them are contributing data for inclusion.

The finished instrument will range from D#-7 in the low bass, to F#-94, six notes above the piano's highest. And there is hardly anything about it that is traditional or conventional.

I'm saving room for a listing of organizations and newsletters on percussion particularly, and experimental or unusual instruments generally. They are hard to find unless someone does an article, which you then happen to read. I learned about your efforts in the April issue of **Percussive Notes**.

Yours Experimentally

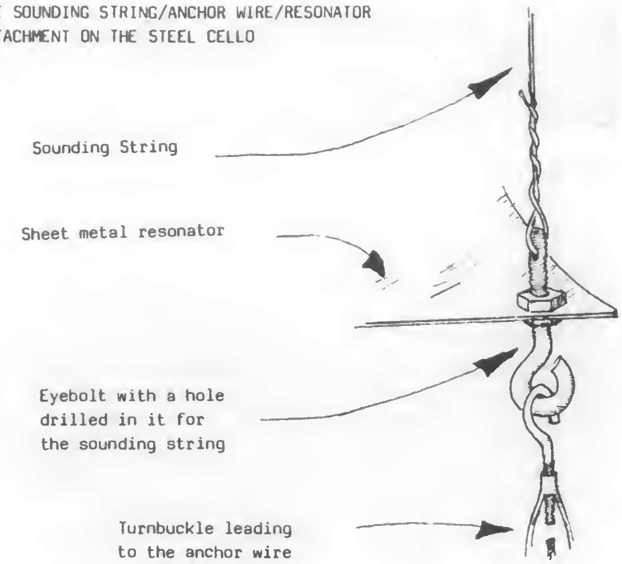
Blake Mitchell
Santa Rosa, CA

ADVERTISING POLICY

Experimental Musical Instruments is set up to survive on subscriptions rather than advertising, but we will run ads which are potentially interesting or valuable to the readership. Please write for advertising rates.

Subscribers can place relevant classified ads of of up to 40 words without charge, and they will receive a 15% discount on display ads.

THE SOUNDING STRING/ANCHOR WIRE/RESONATOR ATTACHMENT ON THE STEEL CELLO



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In response to the article on voice modifiers, I recently learned of an interesting mirliton for transverse flute. While shopping in Chinatown in San Francisco I purchased a simple bamboo flute. Another shopper told me that the store also sold flute paper. After expressing a confused look, I learned that a very thin rice paper is sold to be placed over a hole in the flute tube, the hole being between the mouthpiece opening and the first fingerhole. The rice paper is attached by placing a piece of the flute paper over the hole and wetting the flute shaft. When the attached rice paper membrane is dry, the flute speaks with a bright buzztone throughout its range. The flute paper membrane is rather fragile and requires the proper tautness during application (too tight will not speak; too loose will cause the paper to tear upon playing). However, it is well worth the bother, as it speaks with a devilishly cutting timbre.

Honestly,

Jordan Hemphill
Hayward, CA

SUBMISSIONS

Experimental Musical Instruments welcomes submissions of articles relating to new instruments. Articles about one's own work are especially appropriate. Smaller articles may be sent, with return envelope, directly to the newsletter. Send a query letter before undertaking any major work. Don't hesitate to write if you have questions regarding submissions and our policies.

THE LONG STRING INSTRUMENT

Designed and built by Ellen Fullman

The standard string instruments derive their sound from the transverse vibrations of the strings. In these strings the predominant vibrational movement, the one which produces most of the sound, is that of the string moving back and forth in a direction perpendicular to its length. But transverse vibration is not the only dance that strings can do: there are other modes of vibration, most notably the longitudinal.

In longitudinal vibration the direction of movement is along the length of the string. The vibration is caused by waves of compression and decompression of the material of which the string is made, comparable to waves in the air or in a liquid medium. In a string which is fastened at both ends, the waves will travel from end to end, bouncing back and forth, and causing any given point on the string to oscillate as the waves pass through. Longitudinal vibrations can be excited by an impulse given to the string in the direction that the waves travel, such as rubbing the string lengthwise with sufficient friction. The frequency of vibration -- the rate at which a given point on the string moves back and forth lengthwise in response to the waves of compression and decompression -- is determined by the length of the string and the velocity at which waves travel through the string's material, according to the formula $F=V/2L$. This means -- and it does work out this way in practice -- that the tension on the string has no effect on the rate of vibration, as long as the string is held taut. Given a string of a certain material, the sole variable determining the rate of longitudinal vibration is the length of the vibrating portion of the string.

By itself a string vibrating longitudinally cannot be heard, since it will move only negligible amounts of air. But, as with conventional

ELLEN FULLMAN PLAYS THE LONG STRING INSTRUMENT

stringed instruments, the string can be attached to a resonator such as a soundboard, which will move enough air to give ample volume. A string vibrating longitudinally readily makes an efficient coupling with a soundboard if it is attached perpendicular to the plane of the soundboard. The connection then is as direct as can be (as with a harp, no bridge intervenes) and, unlike strings vibrating transversely, the primary direction of vibration of the string is the same as that of the soundboard.

So why have instrument designers in the past not made more use of longitudinally vibrating strings? There is a very practical reason.

Longitudinal waves travel through different substances at varying, but generally very high speeds. The velocities at which they travel through the materials of which strings can be made are in the range of tens of thousands of feet per second. If you look back at the formula given above for determining the frequency of a string vibrating longitudinally, you will see the implication of these velocities: in order to produce fundamental tones which are within the range in which we can identify musical pitches, the strings must be outrageously long. Ellen Fullman provided the chart below, showing the length of string necessary to produce certain pitches for certain materials.

(Fullman has found the figures given in this chart to be somewhat inaccurate, but they do provide a broad picture.)

VELOCITY OF LONGITUDINAL WAVES THROUGH WIRES OF VARIOUS MATERIALS AND WIRE-LENGTHS REQUIRED TO PRODUCE SOME SAMPLE PITCHES.

MATERIAL AND DIAMETER OF WIRE	VELOCITY OF WAVE IN FEET/SECOND	LENGTH AT WHICH THE WIRE SOUNDS A SAMPLE PITCH	
0.012" Iron	22,421 ft/sec	A-440	25' 6"
0.0135" Iron	22,110 ft/sec	A-440	25' 3 1/2"
0.0135" Bronze	11,513 ft/sec	A-220	26' 2"
0.014" Brass	10,908 ft/sec	A-220	24' 9 1/2"
0.013" Brass	10,972 ft/sec	A-110	49' 10 1/2"

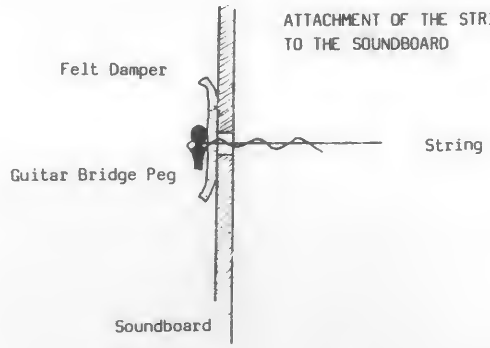
It becomes clear that, in order to exploit the musical possibilities of longitudinally vibrating strings, one must have a very large parlor.

FULLMAN'S INSTRUMENT -- DESIGN AND CONSTRUCTION

With her Long String Instrument Ellen Fullman has created a working longitudinal vibration string instrument. A description of the instrument follows, and Fullman's own account of the project's progress from a chance observation to a fully functional (though still evolving) musical construction appears a few pages hence.

The specific form of the Long String Instrument varies from one installation to the next. The most recent manifestation of the instrument has fourteen strings in two groups of seven. Their full length (as opposed to their sounding length) is ninety feet. At one end the strings are attached to some stable surface, such as a wall. On earlier versions of the instrument the strings were held taut at this end -- but not tuned, since tension does not effect tuning -- by means of several sets of machine pegs made for string basses. Fullman has since discovered that the job can be done more effectively by a wratcheted infinitely-turning winder, a device made in Belgium and used by European farmers for stringing fence wire.

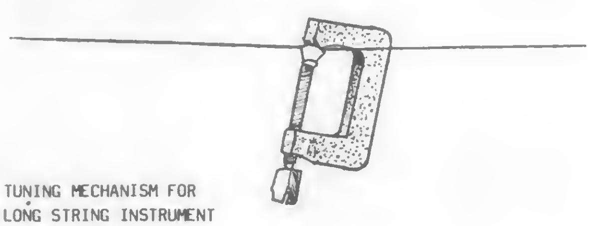
At the opposite end the strings are secured to a rectangular soundboard, eight inches by fifty-nine inches, made of spruce. Each string passes through a hole in the soundboard and then through a damper of felt, and is tied to a guitar peg on the far side. The tension on the string pulls the peg fast against the soundboard, and the damper between prevents buzzing.



ATTACHMENT OF THE STRING TO THE SOUNDBOARD

Fullman, with input from others, is currently redesigning the soundbox that supports the soundboard. The soundboard and soundbox arrangement has taken several forms as the instrument has evolved. Earlier versions were far heavier and larger. But the smaller, lighter board, though seemingly out of proportion to the great length of the strings, is appropriately proportioned for the frequency and intensity of the vibrations it is designed to project. It produces a sound that is louder and warmer than larger boards, and reproduces the detail of the strings' overtone content more clearly.

The strings are tuned by adjusting their sounding length. Fullman does this with C-clamps. They are clamped on the string and left suspended there at the point where the vibration should stop in order to produce the desired pitch. One can calculate this point using the frequency formula given above. It seems surprising that the clamp,


THE TUNING MECHANISM FOR THE LONG STRING INSTRUMENT

resting on the string and affixed to nothing rigid, would be sufficient to stop the vibration in such long strings. But if the mass of the clamp is equal to or greater than that of the string it can function as a nearly-fixed termination, and it does not take a very large clamp to equal the mass of the relatively thin (.0125" diameter) string.

PLAYING TECHNIQUE

To sound the instrument, the player uses violin bow rosin on both the strings and the hands, and strokes the strings lengthwise. The strings sound best with a moderately light touch. Fullman compares it to the way one coaxes the tone from a wine glass by running a finger around the rim. The optimal speed for the stroke is, to use another of Fullman's metaphors, slow like the movements of T'ai Chi. The player walks back and forth along the strings as she plays, giving performances a choreography shaped by the music.

TUNING

Fullman has evolved a tuning system designed to fit the form of the instrument and its playing technique, and which feeds directly into her processes of composition and improvisation. The strings are grouped in two or more sets of several strings -- the precise numbers have varied from one installation of the instrument to the next. Within the sets the strings are spaced closely enough that two or more strings can easily be played simultaneously. Fullman tunes the strings within each set to intervals which she determines will work well together for her compositional purposes, considering the relationships both of fundamentals and overtones. Adjacent strings are not tuned to adjacent scale steps, but to selected harmonic intervals. The other sets of strings are tuned to the same relative intervals, but at different pitch levels, allowing for a form of modulation and for some complex harmonies.

TIMBRE

The Long String Instrument derives much of its flavor from a peculiar attack and decay and the equally peculiar behavior of the overtones. The fundamental -- the object of all those calculations concerning the rate at which the wave travels through the medium -- is always clearly present. But a mix of very prominent overtones shifts dramatically according to where the player strokes the string. The nearer the strokes to one or the other end, the higher are the overtones that predominate. Toward the middle of the string one gets all the lower overtones very clearly and recognizably. If the stroke begins very near one end and moves toward the center, a waterfall of high overtones tumbles out over the fundamental in the first moments of the tone, descending rapidly. The descent continues, but ever more slowly, with the movement toward the center, as the fundamental remains more or less constant.

Like a bowed instrument, the long strings sing as long as the stroke lasts. But unlike with transversely vibrating strings, whose vibration will die away slowly if they are not muffed, the longitudinal vibration ceases abruptly after the stroke ends. In Fullman's instrument, a quieter echo of fairly fast decay can then be heard; it is the vibration in the soundboard giving up the ghost a trifle more reluctantly.

THE MUSIC

The Long String Instrument lends itself to long tones and sustained harmonies, and this is reflected in Fullman's composition. Her pieces are built around predetermined sets of harmonic relationships within which performers can improvise using certain strings and their overtones for a period of time and then moving on to the next set of relationships. Two players usually perform together, engaging in their T'ai Chi walk along the length of the installation as the music dictates. Fullman has performed at galleries in New York and has brought the instrument -- dismantled for the journey, needless to say -- to performances in Europe as well.

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Recordings of the Long String Instrument are not commercially available at present. A gallery in Holland has made tentative plans to produce a record within the next year or so which will probably be available through New Music Distribution Service (500 Broadway, New York, NY 10012).

For more information about the instrument, performances and the like, Ellen Fullman may be reached at 17 Kent Ave., Brooklyn, NY 11211.

ARNOLD DREYBLATT AND ELLEN FULLMAN AT THE LONG STRING INSTRUMENT
Photo by Peter Cox, Eindhoven, Netherlands

ELLEN FULLMAN WRITES ABOUT THE EVOLUTION OF THE LONG STRING INSTRUMENT

For the past several years I have been developing an installation, "The Long String Instrument". In 1981, in St. Paul, Minnesota, I was stretching long lengths of string using various materials and tying them to metal containers. The containers acted as resonators and were amplified with contact microphones. I bowed the string and put water in the containers, moving them and listening to the resonance change. One day I brushed against one of these strings and it made a loud clear sound. I began stroking it lengthwise with my hands. I sensed that what I was discovering had a lot of potential but I needed to learn what was happening scientifically to be able to control the sound produced. I was unable to find the kind of information that I needed in Minnesota, although I'm sure it exists there. I saw evidence of there being more integration of art with technology in New York City, and decided to move there.

For about a year in New York I took false steps in relation to the project. I wanted a warm, low sound, and to be able to tune the strings. I tried using a better contact microphone and tried to modify the sound by electronic filtering. I was now using very large containers of water and setting up the strings on the roof of my building, the only place large enough. One afternoon Steve Cellum, and engineer, explained to me how the string was vibrating. We had on hand a large board, originally used to reflect the sound. Steve suggested that we attach the string directly to it. We drilled a hole, put the string through, tied it to a washer, then tightened it against the board. The string produced a loud, rich sound without amplification.

Soon after, I set up the project in a better location and began building test resonator boxes. At this time my friend Arnold Dreyblatt, a composer, brought over his friend Bob Bielki, an engineer, to look at what I was doing. Steve was also there, and we tried several experiments which greatly clarified the procedure I was to take. In a physics handbook they found a formula which was to become my method of tuning. We also discovered that by using brass wire, I could lower the frequency produced. It seemed that the next step was to build a large box resonator that would sustain the sound longer than only a board.

My next studio space was the Terminal New York Show which was to begin a month later. I spent the intervening time reading about musical acoustics, planning the box, and gathering materials. In the show I had a very large area to work in and built a large plywood box. I suspended the strings from this in clusters of four, tuning the groupings to equally tempered chords. I spent this period listening to different combinations of tones and thinking about the musical possibilities.

When the show was over some friends let me use their basement to work in. The strings ran through a doorway and into another room with the bass section extending down a long hallway. At this time I met David Weinstein, a composer, and we began a series of sessions in which David taught me about just intonation. Since overtones are so clearly present in this instrument, a tuning system using just intervals seemed more appropriate and more interesting.

I tuned the instrument in various ways, listening to ancient systems and generating my own. I settled on a just 12-tone chromatic scale based on F. Rather than in chromatic sequence, the strings were laid out in a pattern in which each string has a simple harmonic relationship to its adjacent strings. This was done so that while playing one string, others beside it could be touched also, adding a harmonic density. I added a second section of twelve strings in the same pattern of adjacencies but tuned in a perfect fifth relationship to the first section.

David and I began playing long, sustained, slowly shifting tones. Our playing was really random, as I didn't know much about musical intervals. In time I began learning more, laying out charts in which I could see the mathematical relationships in chord structures. I realized that, since the overtone series is swept through in each string as it is played, complex, shifting chordal relationships would occur when two or more strings are played at once. I began building chord sequences in which I stroked the same strings walking away from the soundbox and returning, listening to the shifting of the chords in the overtones. Now I'm interested in dealing with time in a more precise way than that delineated by the player's footsteps.

The project has become for me my personal music school. It leads me to read and study, as the information I seek gets put to use in very practical ways. The piece is like a microcosm of the history of music. The lessons I learn materialize in a very graphic form. There is a quality of its being a science project that displays principles of musical acoustics. I am an outsider to music, and it's as if now I am seeing the inner workings, the gears, pulleys and bricks that build music, and it's my intention to affect the listener the same way.

INSTRUMENTS

ROWELL'S CERAMIC OCARINAS, continued from page 1

Rowell describes her work in the article that follows. In response to the editor's request, she provides a lot of practical information regarding tuning, tone hole placement, and the very subtle art of getting fipples to do what they are supposed to do. A few words on some of the other people making vessel flutes can be found in the box on page 10.

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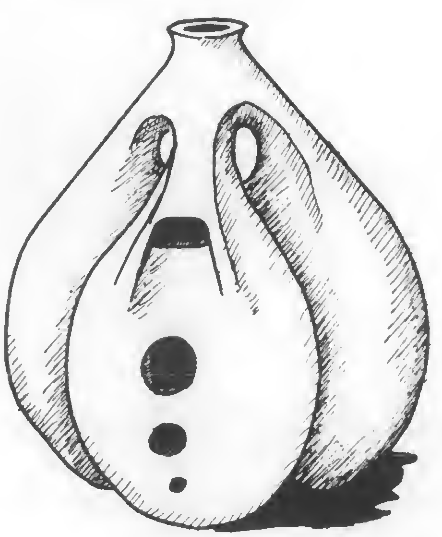
I make a triple-chambered clay wind instrument of fipple mouthpiece construction, with a common entrance to the windway so that all three chambers may be played at once. Each of the two front chambers has four finger holes in a row, which, by employing the "pennywhistle" system of fingering, produce an octave on each of the two sides. The drone is usually a single bass note, and the entrance to the windway is split so that one may play or not play the drone as one chooses. On some instruments the drone has two extra holes controlled by the edges of the palms near the base of the thumbs, producing a total of four possible bass notes.

Most of my instruments are "C" instruments, although very large ones may start at F below middle C or lower, and small ones may start at F above middle C. The clay shrinks in drying and firing, making it difficult but not impossible to make instruments that are perfectly pitched for playing in a group. With low firing most clays shrink enough to raise the pitch of the instrument about a semitone. It is possible to play the instruments while they are soft if one does so sparingly and handles them gently, so the testing and fine adjustment of the mouthpiece and tone holes can be done prior to firing.

TRIPLE-CHAMBER OCARINA MADE BY SHARON ROWELL



I devote as much attention to the sculpture of these instruments as to their musical quality. The shapes are my own, but I have been much influenced by contours found in the double vessels of American Southwest Indian pottery. The clay surfaces on my forms are often highly polished. After being bisqued for greater durability, the pieces are reduction fired, resulting in a beautiful shiny black, reminiscent of San Ildefonso and Santa Clara black pottery. For contrast, others are pit-fired, resulting in ancient-looking things, full of different fire colors.

SCALES AND FINGERINGS

In the traditional four-hole penny-whistle fingering system, all the chromatic semitones within one octave are available except the minor second and minor third. This defect in the system -- the incomplete scale -- is offset by the great ease of playing when so few holes must be covered, and the all-important fact that this allows the player to control each chamber with one hand. However, I have found that by adding a fifth hole for the thumb the range can be extended to an octave and a minor third, and the minor third below filled in as well.

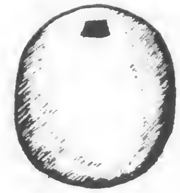
Below is a fingering chart for the first octave in traditional pennywhistle fingering.

In general, each hole in the ocarina serves for two notes. The higher is obtained by having the hole and all holes below it open. The lower note is obtained by closing the next hole below the open one. In most cases, to obtain the flattened lower note one closes two holes below the open one. This pattern gives a sort of crazy-quilt feeling to the ascending and descending scales, but it takes very little practice for it to become totally automatic.

HOLE SIZE AND PLACEMENT

With vessel flutes, unlike with open-ended tubes such as flute and recorder, the location of a given tone hole has only a minor effect on the resulting pitch: the size of the hole is the important factor. One gets a certain rise in the tone based primarily upon how much new area is opened up in holes. Accordingly, the holes may be placed wherever is convenient for the fingers, and tuning achieved by adjusting their size. The holes are all smaller if the mouthpiece window is small, and larger if the window is large, and each hole in the ascending scale is larger than the preceding one.

They look like this:



The window may be cut on top, or a little forward onto the face of the instrument, as shown here.

METHOD OF CONSTRUCTION

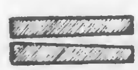
1. First, the hollow chambers are constructed of clay -- usually two that will become melody chambers plus one or more for drones. The walls may be thick or thin, smooth or irregular, round or long and narrow. The smoothness or jaggedness of the inside is unimportant. Any shape, including even a hollow "inner tube" works well. I pinch two pots for each planned chamber

and join them carefully into one.

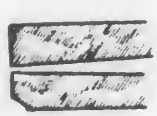
The following steps are performed for each of the chambers:

2. A solid cylinder for the mouthpiece is rolled out in clay and set aside to get a little harder.

When it is leather hard, a fettling knife or something similar (I use a valve measurer from an auto shop) is pierced through the tube, creating the windway. A lot of experimentation is necessary to determine the ideal width and height of the windway exit. Before the knife is withdrawn it can be jiggled a bit to slightly bevel the windway toward the narrower exit.



The mouthpiece is now cut below the windway exit at about 45 degrees.



3. A window is cut in the hollow playing chamber where the mouthpiece will be joined. Experimentation will determine the best dimensions, but except in very small instruments, a rectangle is usually cut rather than a square. A larger window produces a louder tone and a higher bass note than a smaller one, and calls for larger finger holes in the body of the instrument.

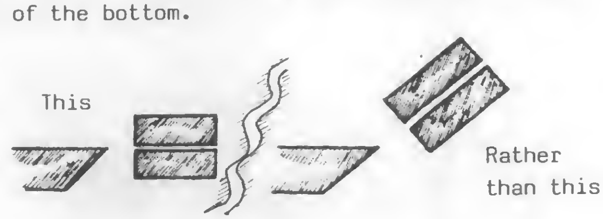
The blade is formed out of the front or lower edge of the window,

by slicing with a sharp knife at an angle. The angle is subject to experimentation, but I favor a fat blade of about 45 degrees.

4. The mouthpiece is fitted to the back of the window. It is simply held there for now, not firmly attached, while one tests for proper alignment as follows.

The mouthpiece is positioned in such a way that when you look through the windway you see the edge of the blade outlined by the upper and lower borders of the windway. The edge of the blade should be visible somewhere in the lower half of the framed field of vision -- exactly where within this range is, once again, open to experimentation.

The angle of attachment of the mouthpiece is such that the air moves in a direction corresponding more to the slope of the top of the blade than that of the bottom.



This angle makes little difference for the lower notes, but it is particularly important if the upper notes are to speak clearly.

The distance from the mouthpiece to the blade affects tone quality and pitch. If it is closer, the pitch of the instrument will be lower and the range tends to be larger, but the price may be an

unpleasant buzziness unless the air is focused by a very narrow windway opening. If the mouthpiece is farther away, the pitch will be higher -- perhaps as much as a whole step -- and the tone will be breathier, more clay-like to my taste, especially if the windway is fairly open. The price may be shortening of the range over which it will speak.

In making multiple resonating chambers served by a common windway entrance, it is important that all of the mouthpiece and blade arrangements be as closely identical as possible. If they differ, the air pressure required for each to create its best tone will also differ. As a result, when two instruments which play well individually are finally joined the maker may find that one of them plays only the bottom notes, or that one doesn't play at all.

5. Next, make and tune the tone holes. They are located on the face of the chamber wherever they are most playable and tuned by adjusting the size: enlarging the hole raises the resulting pitch. If one finds during tuning that some of the finger-holes are becoming unplayably large one can compensate by shaping them as ovals, more in the shape of a finger laid flatly against the hole, and also by bevelling the holes inwardly. Or one can reduce the necessary fingerhole size by reducing the size of the window and retuning in the now-lower key.

The drone or drones can be tuned either by varying the chamber size or by making a single, permanently open tone hole. One can also make drones to produce more than one pitch: on smaller instruments one or two thumbholes properly placed can be accessible, and on any size instrument it is possible to have one hole for each palm, making four notes available.

6. After each of the chambers that will make up the finished instrument have been formed and tuned separately, they can be attached chamber to chamber, in such a way that the mouthpiece openings end up adjacent to one another. Whatever tubing is necessary to bring them together is carefully added; they are then enclosed in clay, and from this clay the outer mouthpiece is formed. The mouthpiece can be split so that the drone may or may not be engaged as desired.

The lower lip blocks the lower part of the windway entrance to disengage the drone.

7. The finished instrument is allowed to dry slowly before firing. Place it under a loose sheet of plastic for the first couple of days, in order to reduce the possibility of cracking. When it is completely dry, fire it more slowly than ordinary single-vessel pottery.

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Sharon Rowell welcomes inquiries, and particularly likes to work on projects involving a new problem to solve or some unique requirement that results in the making of a one-of-a-kind musical instrument. She also conducts workshops. Her address is P.O. Box 604, Stinson Beach, CA 94970.

MORE VESSEL FLUTE MAKERS

ALLEN ALBRIGHT

Allen Albright's beautiful hardwood double ocarinas used to appear regularly at craftsfairs and in crafts shops all over Northern California and elsewhere. Often the maker himself could be found at these venues, playing his own instruments with striking virtuosity. He left to take up residence in France six or seven months ago, and his instruments will now be a bit harder to find.

Albright's finely-wrought instruments have a bright, recorder-like tone and impeccable tuning. In 1982 he assembled a listing of makers called "Folk Wind Instrument Sources" and put out a **Folk Winds Newsletter**.

MARLIN HALVERSON
2363 Kern St., San Bernadino, CA 92405

Marlin Halverson comes to instrument making through sculpture and the visual arts. He makes and sells beautifully-worked, highly decorated instruments using several different woods, in surprising, highly sculpted shapes. In addition, he makes a line of more conventionally designed ocarinas. In 1982 he organized and curated the "Sonic Art" exhibition of new instruments and sound sculpture at California State College, San Bernadino.

SUSAN RAWCLIFFE
P.O. Box 54452, Los Angeles, CA 90054
(213) 663-4279

Susan Rawcliffe makes and sells ceramic flutes, single, double and triple pipes and ocarinas, and strange and wonderful whistles, all in a variety of sizes and in either standard or esoteric scales. She performs and gives workshops, and has exhibited her work extensively. "Clay Music", a recording of music written by Barney Childs for her instruments, is available through New Music Distribution Service (500 Broadway, New York, NY 10012).

RECORDINGS

THE GLASS ORCHESTRA '84
Available from The Glass Orchestra
81 Portland St., Toronto, Canada M5V 2M9

Cassette recording of the Glass Orchestra in concert October 4th, 1984, in Toronto.

Four musicians from Toronto make up the Glass Orchestra: Paul Hodge, V. Eric Cadesky, John Puchiele (recently replacing Jon Sidall), and Miguel Frasconi.

Every sound the Glass Orchestra produces uses glass somehow or other. With most of the their instruments glass is the primary vibrating substance, excited by striking, scraping or friction. With others glass serves to modify sounds from other sources, including wind, water, and the human voice.

The group makes its current material available on cassettes, which it occasionally updates with more recent recordings. The current version of their cassette contains material recorded at a concert late last year. The four pieces included are diverse in style; the sounds that the orchestra produces are fresh and appealing, often surprising, sometimes funny; the compositions and improvisations are imaginative and accessible; the fi of the recording is satisfactorily hi; all in all the tape makes excellent listening. One can listen primarily to immerse oneself in the sensual experience of some unusual sounds, or one can listen as if John Cage had never existed, riding along on melody, rhythm and structure -- the music is satisfying either way.

The Glass Orchestra works with a mixture of improvisation and prescriptive composition. They handle prescribed elements with a combination of conventional notation, verbal instructions and rote learning. There is a limiting factor on composition for the group though: one cannot become too attached to a particular sound in a particular piece, for the instrument required to realize it might get broken at any time. The ensemble plays an ephemeral and ever-changing gamelan, continuously evolving as one-of-a-kind instruments break and are replaced by new instruments and new sounds.

Many of the glass instruments produce definite pitches. Some of the definite-pitch instruments are found objects and are difficult to tune. These may be accepted into the ensemble as they are, their pitch being added to an already colorful palate without further ado. Others, such as water-filled wine glasses, resonated-bar instruments and some of the wind instruments, are tunable. Members of the group do their tuning on different instruments independently of one another, according to their own lights and without agreeing on a tuning system in advance. In performance, as a result, several tuning systems operate simultaneously. A lot of the time the effect of this mix is simply a rainbow of pitches and intervals which the listener feels no need to organize tonally. At other times he may be able to isolate aurally one of the tuned instruments, so that its intervalic structure fleetingly becomes meaningful to the ear. Over the next moments that instrument might remain prominent, or the tonal ambiguity of the whole might once again engulf it, or another instrument, speaking some unrelated tonal language, might rise to the surface.

The Glass Orchestra made a couple of recordings prior to this cassette. Their album "The Glass Orchestra," on the Music Gallery Editions label, appeared in 1978. It is still available for $8 from the Glass Orchestra at the Toronto address given above, or through New Music Distribution Service, 500 Broadway, New York, NY 10012. The pieces it contains are generally more improvisatory than the more recent work. An EP entitled "Tales from Siliconesia," recorded in 1981, is also available from the Toronto address and from NMDS. One side is all improvised silliness; the other an interesting and more serious work. The material on the '84 cassette, however, is more enjoyable and more substantial than that on either of these earlier recordings.

The group will be touring in the spring of 1986. There will be concerts at the Performance Gallery at 3153 17th Street in San Francisco on May 14th through 17th, followed by performances in Seattle and Vancouver, exact dates and venues not yet established.

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Another recording of glass music is "The Glass World of Anna Lockwood," recorded in 1970 on Tangent records. This LP explores a wide array of sounds for their innate characteristics, without attempting to create larger musical structures. Says Lockwood on the record jacket: "I have treated each sound as if it were a piece of music in itself. For me, every sound has its own minute form -- is composed of small flashing rhythms, shifting tones, has momentum, comes, vanishes, lives out its own structure." Lockwood's record is also available through New Music Distribution Service (address given above).

AMIS, continued from page 15

of Bartolomeo Cristofori," "Early Bassoon Reeds: a Survey of Some Important Examples," and "The Diatonic Harp in Ecuador: Historical Background and Modern Traditions." The newsletter is a touch less formal -- in its own words, "...designed specifically to be a vehicle for communication between all AMIS members, with or without scholarly pretensions."

Membership in the American Musical Instrument Society is $20 per year; half that for students. Write to

American Musical Instrument Society
USD Box 194
Vermillion, SD 57069

UPCOMING EVENTS

If you are have information about upcoming concerts, workshops or exhibitions involving new instruments, write to **Experimental Musical Instruments** as far in advance as possible, and we will pass the news on in the next issue.

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Richard Lerman's Travelon Gamelan will be presented at the Brattleboro Museum in September. Participants in the Travelon Gamelan ride an orchestra of prepared bicycles equipped with spoke-strikers and portable amplification systems. Participants travel en masse, in a swirl of sound, along a designated route through the streets.

Robert Rutman, inventor of the Steel Cello and other instruments, will be arranging a series of soirees featuring the U.S. Steel Cello Ensemble, to happen on Sundays starting this Fall. They will take place in his studio at 265 Pearl Street, Cambridge, MA.

"A Noise in your Eye", an exhibition of sound sculpture and installations currently touring England, will be at the Mappin Gallery in Sheffield until August 31st, at the Huddersfield New Music Festival in November, at the Greater Manchester Arts Center in January and February, and at Barbican Center in London next April. Participants include the Baschet brothers, Hugh Davies, David Sawyer, Charles de Mestral and Sonde, and several more.

"Klangskulpturen '85", also a sound sculpture exhibition, will be at the Leopold Hoesch-Museum in Duren, W. Germany through August 25th, and at Refektorium des Karmeliterklosters, Frankfurt-am-Mein, September 4th through 20th. Participants include the Baschet brothers and several German, Swiss and French sound sculptors.

RECENT EVENTS

SOUND WAVE FESTIVAL

The Sound Wave Festival happened on May 4th at Candlestick Point State Recreation Area just south of San Francisco. The event was a celebration of wind and sound and people, with sound sculptures set up around and about the park, people looking, listening and partaking, musicians performing in their midst, and -- it could never let us down at Candlestick -- wind everlasting.

Most of the sound sculpture installations were the work of students of Bill and Mary Buchen, in San Francisco from New York for the Spring and teaching a class in the San Francisco State University art department. The student pieces included Sonic Croquet, in which each wicket is equipped with found-object bongs and clangs; an automatic bowed-string instrument made of a hack saw, electric motor and old Audi parts; and the likeness of a horse, formed with black pipe and rods, with marimba-bar ribs. There was (continuing the marimba-animal theme) a set of wooden bars held like a suspension bridge by two lateral ropes, creating between the whole set of them the shape of a fish. The longest and lowest pitched bars, you'll see if you envision this, were the ones in the middle, with the pitch ascending toward either end. Two people were playing an irresistibly bubbly duet on this thing -- some instruments seem to work so well outdoors -- and I still don't know if they were just a couple of stray percussion geniuses that happened to be meandering through, or if their performance was planned. Mary Buchen made a huge number of soda-straw oboes and coffee-can cuicas on the spot and handed them out to all comers. Both were to be heard throughout the park all day.

The one permanent installation at the festival

PERCUSSIONISTS AT THE FISH MARIMBA

was the Buchen's newly-installed Wind Antenna. The Wind Antenna is an aeolian harp standing about twenty feet high on a slight rise not far from the water's edge. The resonator for the harp (which looks in no way like a conventional harp) is a parabolic dish of about six feet in diameter, resting concave-side-down atop an aluminum pole. A large number of relatively narrow-gauge strings are attached to the perimeter of the dish all the way around, extending down at an angle to converge at a point on the pole several feet below but still well off the ground. The sound of the Buchens' harp, rising and falling in the gusting winds, contains a continuous wash of extremely high overtones, creating an effect a little like white noise. Through this one hears a colorful and constantly shifting array of not-quite-as-high tones. Lower frequencies were not audible when I heard it sing.

The live music for the Sound Wave Festival included an improvisation by Tom Nunn, Chris Brown and percussionist William Wynant. Tom Nunn and Chris Brown both have some remarkable instruments to their credit, and used some of them in this performance. Brown played his Wings -- a balloon-mounted bowed-metal instrument -- and Gazamba, a sort of keyboard percussion-ensemble-and-more. Nunn played the Crustacean, another bowed-metal instrument, and the Mothra, which is the latest incarnation of his earlier Wavicle Board, an assembly of everything you could imagine on a resonator. Since this newsletter will feature these instruments in coming issues, I won't say more about them here, except that the improvisation was a feast.

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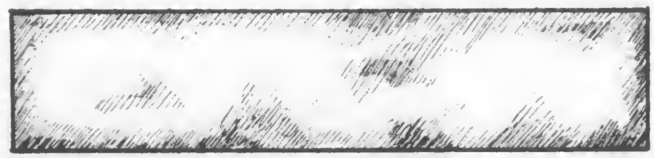
The festival was a project of the Candlestick Point State Recreation Area Environmental Sculpture Project, with Leonard Hunter, Director, and Bill and Mary Buchen, Artists-in-Residence and festival curators. Baseball fans know Candlestick Park, home of the San Francisco Giants, losingest team in major league baseball in 1984. A few years ago the state of California began to transform the landfill bayshore area around the stadium into parkland. An active and progressive park administration early on brought Hunter, an art professor at San Francisco State, into the project. He in turn made connections with the Buchens and other people from the art community. He also set about obtaining funding, getting grants from the National Endowment for the Arts, Meet the Composer, the California Arts Council, and a number of other public and private sources.

If the Environmental Sculpture Project group has its way much of the site will become a sculpture park, with permanent sculptures by many artists in place all around. Plans call for one section to be laid out as sound-sculpture garden.

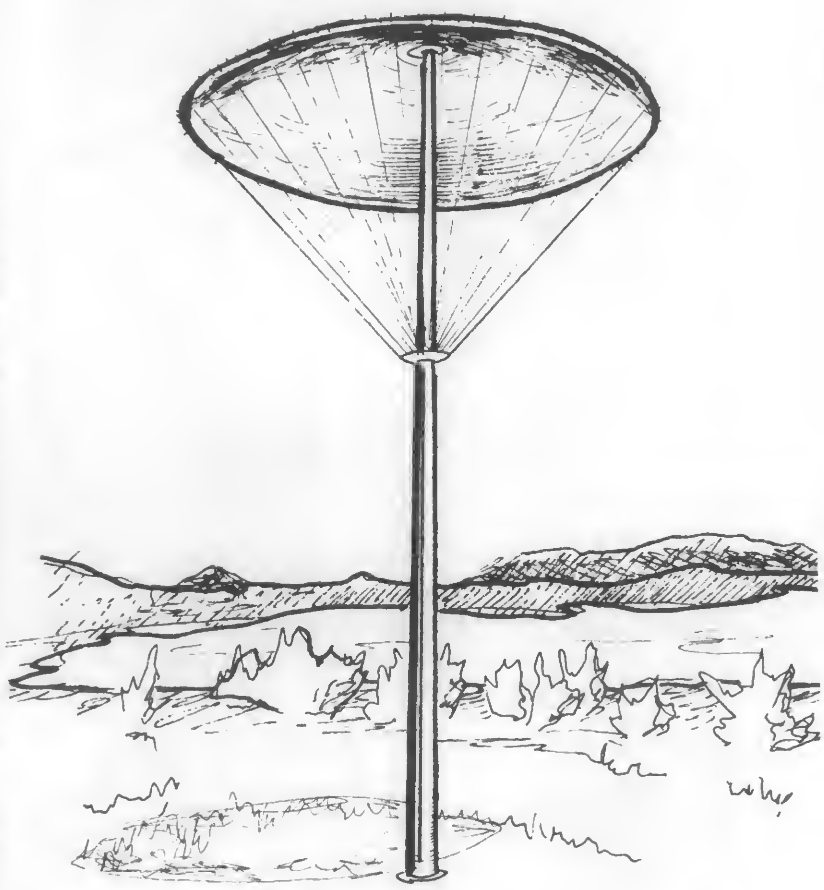
Two guiding principles underlie the project. The direction that the development of the park takes must be appropriate to the needs and desires of the surrounding community, and it must be in keeping with the nature of the parkland's environment. The outstanding environmental feature of the area is the perennial wind. This was a central consideration in the decision to make a wind harp the first permanent installation, and in the selection of the Buchens as Artists-in-Residence at the park.

The Buchens were an appropriate choice because they have worked both with wind harps and with sound sculpture parks and similar environments in the past. They were largely responsible for a four-acre sound park at Lake Placid which included a huge wind harp, suspended lithophones (stone chimes) and a number of other sound works. In an old recreation hall in the Catskills they created another environmental sound work in the form of a sonic miniature golf course.

The Buchens are back in New York City now, but the hope is that their work with the park will continue. If all goes well we will see a new sculpture garden come into being, and with it, more events like the Sound Wave Festival.



THE WIND ANTENNA -- The Buchen's wind harp.



VOICE MODIFIERS FOLLOW-UP

In the last issue of **Experimental Musical Instruments** we asked after people working with instruments designed to enhance or modify the sound of the human voice. Some gleanings from the responses follow.

Some people wrote in with comments on the related subject of mirlitons used to modify the tone of flutes. Their observations appear in issue's Letters.

In an interview in the current issue of **Musicworks**, members of the Logos Foundation from Belgium talk briefly a metal voice resonator they have built. The body of the instrument is a large metal can with an opening cut in the side. A heavy metal coil spring, like that used in garage door openers, is welded to the bottom inside. When one vocalizes into the can, the can and spring together resonate strongly with the voice, but in their own peculiar timbre, producing a response far greater than what either could do alone. More information on this special issue of **Musicworks** is on page 16.

Tom Nunn's Crustacean, a balloon-mounted metal-resonator instrument with bowed metal rods, responds similarly to the voice, although voice resonance is not its main purpose in life. Tom describes the Crustacean in an article which will be appearing in **Experimental Musical Instruments** one or two issues hence.

When all is said and done, the Logos people's can-and-spring instrument is the only new acoustic instrument we received word of that is designed primarily for enhancement of the voice. Perhaps there isn't much more happening in this area, rich in potential though it may be. Still, the door remains open here -- write us if you or others you know of are working with voice modifiers.

BOOKS

EMIL RICHARD'S "WORLD OF PERCUSSION"
by Emil Richards
Published by Gwyn Publishing Co.,
P.O. Box 5900, Sherman Oaks, CA 91413
Agent for Warner Bros. Publications Inc., New York

RANGE FINDER FOR THE "PERCUSSION" SEEKER:
A LIST OF SIX HUNDRED PERCUSSION INSTRUMENTS
by Emil Richards
(with a handwritten, xeroxed update)
Published by Emil Richards
Box 27037, Los Angeles, CA 90027

Emil Richards is a percussionist with a long list of credits, including work with many top-notch band leaders and performers, lots and lots of studio work and movie sound tracks, and tours that have taken him all over the world. In the course of his career he has assembled a huge, varied and wonderful collection of percussion instruments, instruments from other musical cultures, and "effects".

In 1972, when his collection was not half the size it is now, he put together his **World of Percussion**. This volume cataloged his collection, presenting photographs, descriptions and, where applicable, pitch ranges for each of three hundred instruments. The book is just under a hundred pages, and the written descriptions of the instruments are necessarily brief. But the photographs, taken by Stan Levey, are attractive and in most cases clear, and they are invaluable in conveying the nature of the instruments.

The instruments, needless to say, are fascinating. The collection is a fantasy land of unusual, exotic and surprising sound making de-

NOTICES

TOM NUNN'S INSTRUMENTS are rare, unique, hard to find -- but they are not unobtainable. The Crustacean, Mothra and others can be made to order and purchased. Tom Nunn, 3016 25th Street, San Francisco, CA 94110, (415) 282-1562.

ATTENTION 'HAMMERED' DULCIMER ENTHUSIASTS !! Subscribe to THE DULCIMIST -- the quarterly journal of dulcimer music, building and playing information, resources and much more. $12.00 yearly ($3.00 single issue). THE DULCIMIST, P.O. Box 1052, Williamsburg, KY 40769.

XENHARMONIKON, a periodical publication exploring the possibilities that open up once one steps outside the 12-tone equal temperament system of intonation, will be revived this Fall. For information write Daniel Wolfe, Editor, 23-A Park Place, Middletown, CT 06457.

vices. For the standard percussion, the photographs frequently display some quirky, handmade instrument rather than the standard mass-produced model. There are all manner of instruments from other cultures, ranging from the usual kalimbas and steel drums to some strange and wonderful specimens the likes of which one rarely gets to see. And then there are a number of sound sources that are Richards' alone, some of them sophisticated instruments of his own design, such as his remarkable water chimes, and some of them just sounds that he stumbled on and found useful, like a life-size hollow plastic cow which happens to have the resonance of a large log drum when struck in the belly.

World of Percussion was originally published by Gwyn Publishing Company in hard back and came with two cassettes demonstrating the sound of each instrument. Tragically, these cassettes are now out of print. Warner Brothers Publications subsequently got hold of the rights to the book and issued a paperback, sans cassettes. Gwyn has apparently taken the book over again, but at this point copies may be a little hard to come by.

By 1977, Richards' collection had grown considerably. He put together his **Range Finder for the "Percussion" Seeker** to represent the expanded collection. Six hundred instruments appear in this volume, but there are no photographs and minimal description; the book's primary purpose is to list the instruments and give ranges. The result is both tantalizing and frustrating. Yes, it would be a lot of work and terribly expensive to produce, but it would be wonderful to see an expanded version of **World Of Percussion**, with photographs and recordings.

Richards has more recently added a handwritten, xeroxed update for **Range Finder**, with slightly more complete and colorful descriptions of his most recent creations and acquisitions.

Currently, Richards is thinking of making the contents of his collection available in a different way. He is hoping to record all of the instruments digitally and make them available for use in electronic instruments through electronic sound sampling technology.

ORGANIZATIONS & PERIODICALS

In each issue, **Experimental Musical Instruments** reports on an organization or periodical publication that is potentially interesting or useful to people concerned with new instruments. If you are part of or know of an organization that deserves mention, please send information to the newsletter at the address given in the masthead.

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THE AMERICAN MUSICAL INSTRUMENT SOCIETY

There are two scholarly societies devoted to musical instruments. The first was the Galpin Society, founded in 1946 in England and still going strong. The other is the American Musical Instrument Society.

AMIS is, in the description appearing in its journal, "an international organization founded in 1971 to promote the study of the history, design and use of musical instruments in all cultures and from all periods." Its headquarters are in Vermillion, South Dakota, and it is at least informally associated with the University of South Dakota. It is also closely allied with the Shrine to Music Museum, which houses one of the finer musical instrument collections around. The society publishes three twelve-page newsletters and a journal of a hundred and fifty pages or so annually. There are annual meetings "with symposia, papers, demonstrations and performances of interest to members." Meetings usually take place where respected collections of instruments are housed: the Smithsonian Institution, the Boston Museum of Fine Arts, and the Metropolitan Museum of Art have been among the venues chosen. The bent of the organization is definitely scholarly and tends to be historical. Articles in this year's journal were "The Colonna-Stella **Sambuca Lincea**, an Enharmonic Keyboard Instrument" [of the 16th century], "The Bassoons in Marin Mersenne's **Harmonie universelle** (1636)," "The Pianos

Continued back on page 11

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RECENT ARTICLES

Listed below are selected articles of potential interest to readers of Experimental Musical Instruments which have appeared in other periodicals in recent months.

MUSICWORKS 30: SOUND CONSTRUCTIONS (1087 Queen St. West, 4th Floor, Toronto, Canada, M6J 1H3).

The current issue of **Musicworks**, inexplicably dated Winter 1985, is devoted to sound sculpture and installations, and makes fascinating reading throughout. Four builders (or pairs of builders) and their work are featured. Moniek Darge and Godfried Willem Raes of the Logos Foundation in Ghent, Belgium, are interviewed about their audience-participatory pneumatic instruments and interactive electric and electro-acoustic oddities. Paul Panhuysen and Johan Goedhart of Eindhoven, The Netherlands write about their site-specific installations using very long strings. Canadian Gordon Monahan writes about his large-scale aeolian harps, and includes in his article a history of aeolian strings. American Lief Brush describes in an interview how he captures and presents the otherwise-inaccessible sounds of natural phenomena including vibrations occurring in icefloes and within the wood of living trees.

The sounds of the featured installations can be heard on a cassette tape that accompanies the journal.

"BASICS OF AIR RESONANCES IN MUSICAL INSTRUMENTS" by W. D. Allen, in **American Lutherie** number 1, March 1985 (8222 S. Park Ave., Tacoma, WA 98408).

In this article W. D. Allen describes the behavior of air waves within enclosed cavities. It refers primarily to the soundbox of the guitar, but widely-applicable acoustic principles are discussed and diagramed in a clear and practical manner requiring minimal math.

"AN INTRODUCTION TO THE BI-LEVEL GUITAR" by David F. Marriott, in **FIGA** (publication of the Fretted Instrument Guild of America), May-June 1985 (2344 South Oakley Ave., Chicago, Il 60608).

Marriott presents and explains an innovation in guitar design by Roger Pytlewski of La Jolla, CA. The soundboard of Pytlewski's guitar has two bends perpendicular to the strings, angling the portion of the board which holds the bridge so that the strings join it at about 45 degrees. This increases dramatically the efficiency of the coupling between the strings and the soundboard, producing greater volume and fuller tone.

"THE PUGET SOUND WIND HARP -- PART 3" by Ron Konzak, in **Folk Harp Journal** #49, June 1985 (31 West Canon Perdido, Santa Barbara, CA 93101).

Ron Konzak, builder of the giant Puget Sound Wind Harp, describes the process of construction with its trials and its joys in this last article of a three-part series. Parts 1 and 2 appeared in FHJ #47 and #48.

"THE FABRIC SHOP TOOMBAH" by Bart Hopkin, in **Percussive Notes** volume 23 #4, April 1985 (214 West Main St., Urbana, IL 61801-0697).

In Jon Scoville's regular "Instrument Innovations" column, **Experimental Musical Instruments** editor Bart Hopkin describes one of his instrument designs, a percussion aerophone in which the air inside a tube is excited by striking the non-rigid wall of the tube.

"DANIEL SCHMIDT: COMPOSITION AND THE DESIGN OF AMERICAN GAMELAN" by Peter Adler and Jody Diamond, in Balungan Volume 1 #2, February 1985 (Box 9911, Oakland, CA 94613).

This is an interview with Daniel Schmidt, designer and builder of American gamelan and director of The Berkeley Gamelan. Schmidt talks about his designs for tuned resonators, his work with metalophones using different metals, composition for American gamelan, and the relationship of the current American gamelan movement to Indonesian tradition.

Experimental Musical Instruments
P.O. Box 423
Point Reyes Station, CA 94956

TO: